

## CLAIMS

What is claimed is:

- 1           1.       A circular directional array antenna comprising:  
2           a driven omnidirectional traveling-wave antenna element coupled to a  
3           transceiver via a feed network; and  
4           a plurality of surface-waveguide elements symmetrically positioned about and  
5           concentrically spaced from the driven omnidirectional traveling-wave antenna  
6           element, each surface-waveguide element configured to receive a control signal  
7           configured to alter a surface-waveguide transmission characteristic.
  
- 1           2.       The circular directional array antenna of claim 1, further comprising:  
2           a ground plane having a plurality of vias, wherein the driven element and the  
3           surface-waveguide elements are adjacent to the ground plane and connected to the  
4           transceiver and control signal, respectively, through the corresponding feed network  
5           and the vias.
  
- 1           3.       The circular directional array antenna of claim 2, wherein the ground  
2           plane comprises a reactive surface.
  
- 1           4.       The circular directional array antenna of claim 2, wherein the ground  
2           plane comprises a conductive surface.
  
- 1           5.       The circular directional array antenna of claim 2, wherein the ground  
2           plane is finite and symmetrical about the driven element.
  
- 1           6.       The circular directional array antenna of claim 2, wherein the driven  
2           omnidirectional traveling-wave antenna element generates an omnidirectional surface  
3           wave substantially parallel to the ground plane.

1           7.       The circular directional array antenna of claim 2, wherein the ground  
2 plane comprises a reactive surface which modifies the shape of the radiation pattern in  
3 elevation with respect to the ground plane.

1           8.       The circular directional array antenna of claim 1, wherein the driven  
2 omnidirectional traveling-wave antenna element comprises a mode-0 slow-wave  
3 antenna.

1           9.       The circular directional array antenna of claim 1, wherein the driven  
2 omnidirectional traveling-wave antenna element comprises a mode-0 spiral-mode  
3 microstrip antenna.

1           10.      The circular directional array antenna of claim 1, further comprising:  
2 a switching circuit having a plurality of inputs and a corresponding plurality of  
3 outputs, the outputs independently responsive to a beam steering means coupled to the  
4 inputs, wherein a respective output is coupled to each of the surface-waveguide  
5 elements.

1           11.      The circular directional antenna of claim 10, wherein the waveguide  
2 characteristic of each of the surface-waveguide elements is selectively controlled to  
3 pass or reflect a traveling wave.

1           12.      The circular directional array antenna of claim 10, comprising:  
2 a conducting enclosure configured to surround the switching circuit to  
3 suppress radio frequency leakage and electromagnetic coupling between the driven  
4 omnidirectional traveling-wave antenna element and the surface-waveguide elements  
5 through the control circuit.

1           13.      The circular directional array antenna of claim 12, wherein the  
2 conducting enclosure comprises mode suppressors arranged around the switching  
3 circuit with a distance between adjacent mode suppressors being less than  $\lambda/4$ , where  
4  $\lambda$  is the wavelength of the highest operating frequency.

1           14.     A method for operating a broadband/multiband beam-steered circular  
2     array antenna, comprising:  
3           locating a driven broadband/multiband traveling wave antenna element that  
4     generates an omnidirectional electromagnetic radiation pattern on a ground plane;  
5           concentrically arranging a plurality of broadband/multiband surface-waveguide  
6     elements around the driven omnidirectional traveling-wave antenna; and  
7           applying control signals configured to steer the electromagnetic radiation by  
8     selectively altering waveguide characteristics of respective surface-waveguide  
9     elements that receive the control signals.